

and demolished a store and its contents, valued at \$2,000. From this place the storm passed in an ENE. direction, and was next heard of at a point about five miles northwest of Hernando. In this vicinity the loss to property and life was very severe, 25 buildings of various kinds were totally demolished and 10 persons killed. Length of storm path about 25 miles, width from 100 to 300 yards. Very heavy rain and hail followed this tornado at Senatobia and several other points in the vicinity, in some cases hail-stones falling the size of hen's eggs. It is of importance to note that the occurrence of electricity or thunder was not reported as observed from any part of the tornado's path. Through portions of Prairie, Monroe, Lee and St. Francis Co's., Ark., 12th, about 2 p. m., violent tornado passed from southwest to northeast, visiting several towns, among which were Brinkley, Forrest City and Cotton Plant. After the passage of the storm at these points showers of jagged pieces of ice, four to six inches in width and two to two-and-a-half inches in thickness, fell, resembling broken river ice. These tornadoes developed in connection with the passage of low area No. III northeastward from Texas to the Ohio valley. On the afternoon of the 12th warm southerly winds prevailed along the West Gulf coast and in the interior of the bordering States, which were opposed to the northward of Arkansas and Mississippi by cold northerly winds, presenting a contrast in temperature of from 35° to 50°. Still further northward in the States of Illinois, Iowa and Colorado snow was reported, with temperatures of 19°, 26° and 27°, and to the southward in lower Texas temperatures of 80° to 90° occurred. Safford, Chase Co., Kansas, 30th, about 6 p. m., tornado passed from southwest to northeast over section of country three miles north of station; path very narrow and destruction of property considerable. This storm developed in connection with an area of low barometer then extending from northern Kansas to central Minnesota and Dakota. On the afternoon of the 30th warm southerly winds, with temperatures ranging from 60° to 87°, prevailed over the Lower Missouri valley, opposed to the northward in Dakota and Minnesota by northerly winds producing contrasts of temperature ranging from 20° to 30°. At Emporia, Kan., very high southerly winds were reported during the day. Total movement from 8.35 to 10.35 p. m., 111 miles; from 10.03 to 10.08 p. m., velocity reached the rate of 72 miles per hour; at 10 p. m., velocity 64 miles per hour. Clay Centre, Kans., 24th, very violent, blowing down houses and trees and overturning railroad cars. Mammoth Cave, Ky., 12th, very severe, maximum wind velocity sixty miles. Garysburg, N. C., 29th, blowing down trees and buildings. Elsworth, N. C., 8th, buildings unroofed and other property damaged. Clarksville, Tenn., 28th, 7 a. m., very violent wind storm; several buildings unroofed. Fort Douglas, Utah, 18th, very violent, blowing down fences and unroofing buildings.

*Water-spouts.*—Cairo, 28th, three water-spouts observed one-half mile southwest of station and in close proximity. Toronto, Can., 26th, 10. a. m., on lake.

## VERIFICATIONS.

*Indications.*—The detailed comparison of the tri-daily indications for April, with the telegraphic reports for the succeeding twenty-four hours, shows the general percentage of verifications to be 85.2 per cent. The percentages for the four elements are: Weather, 91.1; Direction of the Wind, 79.8; Temperature, 85.9; Barometer, 83.6 per cent. By geographical districts they are: for New England, 78.9; Middle States, 82.4; South Atlantic States, 86.0; Eastern Gulf States, 82.5; Western Gulf States, 87.8; Lower Lake region, 82.5; Upper Lake region, 82.2; Tennessee and the Ohio valley, 87.8; Upper Mississippi valley, 82.1; Lower Missouri valley, 82.8; Northern Pacific coast region, 89.4; Central Pacific coast region, 96.0; Southern Pacific coast region, 92.1. There were 88 omissions to predict (33 being due to the absence of reports from the Pacific coast) out of 3,690 or 2.44 per cent. Of the 3,602 predictions that have been made, 113, or 3.13 per cent, are considered to have entirely failed; 116, or 3.22 per cent, were one fourth verified; 457, or 12.69 per cent, were one-half verified; 453, or 12.58 per cent, were three-fourths verified; 2,463, or 68.38 per cent, were fully verified, so far as can be ascertained from the tri-daily reports.

*Cautionary Signals.*—119 Cautionary Signals were displayed during the month, of which 90, or 75.6 per cent, were fully justified by winds of 25 miles per hour or over at, or within a radius of 100 miles of the station. 29 Off-shore Signals were displayed, of which 24, or 82.75 per cent, were fully justified; 27, or 93.1 per cent, justified as to direction; 25, or 86.26 per cent, justified as to velocity, and 1, or 3.4 per cent, completely failed. 19 of the Off-Shore Signals were changed from Cautionary. 148 Signals of all kinds were displayed, of which 114, or 77.02 per cent, were fully justified. The above does not include signals ordered at display stations where the velocity is only estimated. 149 winds, of 25 miles or over, were reported, for which no signals were ordered. 2 signals were ordered late.

## NAVIGATION.

*Stage of Water in Rivers.*—In the table on the right-hand side of chart No. III are given the highest and lowest stages of water, as observed on the Signal Service river-gauges during the month of April, 1881. The Ohio, Tennessee, Cumberland, Monongahela and Savannah rivers reached their highest stages between the 14th and 18th, none of which reported any dangerous rises during the month. The Red and Arkansas rivers reached their highest stages, the former

on the 1st and the latter on the 17th, and, as compared with the past month, a marked fall was experienced, ranging from 7 to 9 feet. In the Missouri the highest stages were reached at Omaha on the 25th, and at Leavenworth on the 29th and 30th, the former rising 7 feet 10 inches above the danger-line, and the latter to 3 feet 10 inches. In the Mississippi the dates of highest water occurred with considerable irregularity at the various river stations, but generally between the 25th and 30th. At all stations above Vicksburg, except La Crosse, there were very dangerous rises, coupled with destructive floods. At the following stations the water rose above the danger-line: St. Paul, 29th, 5 feet 2 inches; Davenport, 12th, 1 foot 6 inches; Keokuk, 24th and 25th, 3 feet 8 inches; St. Louis, 30th, 1 foot 1 inch; Cairo, 19th and 20th, 5 feet 10 inches; Memphis, 26th to 29th, 2 inches; Vicksburg, 4th, 4 inches.

*Ice in Rivers and Harbors.*—The following items, relative to the breaking up or continuance of ice in such bodies of water throughout the northern sections of the country, exhibit the same for the month of April, 1881. In general all rivers and other larger bodies of water between the latitudes of 40° and 55° N. are open and nearly free of ice. There are one or two instances where small isolated bodies remain frozen, but so situated as to be governed by entirely local influences. As distributed by States the following arrangement of dates will indicate, about as near as possible, the time of breaking up of ice or opening of the various water-courses, &c. The dates will differ within the same geographical boundary as various parts of one State or district were at dissimilar times subjected to peculiar atmospheric influences: Dakota, 4th, 7th, 8th, 15th, 19th, 21st, 22nd, 25th; Manitoba, 20th, 21st, 25th, 27th; Minnesota, 7th, 19th, 22nd, 23rd; Wisconsin, 20th, 22nd, 25th; Iowa, 2nd, 5th, 15th; Illinois, 16th, 18th, 21st; Nebraska, 8th, 15th, 20th; Upper Lakes, 18th, 22nd, 25th, 27th; Lower Lakes, 2nd, 5th, 11th, 18th, 24th, 26th; New England, 16th, 20th, 22nd. *Missouri River.*—Yankton, 4th, ice gorging and flooding the lower portion of the city; the lower floors of over 200 dwellings, shops and mills were covered from 1 to 4 feet; great damage to property. 7th, gorge broke; water falling rapidly; steamer *Peninah* carried away from her moorings and lodged on a railroad track two miles down the river; reports from the submerged farming districts state that about 200 persons have perished from cold and hunger; thousands of cords of wood have been carried away by the ice, leaving whole communities destitute of fuel. 12th, river stationary; ice running in channel. 13th, water in the overflowed districts gradually subsiding; ice piled to a height of 10 to 30 feet along the banks, on the bars and over the bottoms. At Green Island every house but one has been swept away; ice throughout the place from 10 to 20 feet deep. Damages to steamboat property estimated at \$60,000, including two boats sunk; seven of the largest steamers lying high up on the ice and far inland. In the vicinity of Yankton it is estimated that at least 7,000 people have been driven from their homes; the ice gorge which has caused this unprecedented flood extended to Vermillion, filling the river channel for a distance of over 30 miles with solid ice and rising in places to a height of over 30 feet above the surface of the water; about fifteen miles below Yankton, in a bend of the river, were situated 20 families, who could not be rescued because of the mountains of ice surrounding them. Omaha, 7th, for several days past heavy floating ice; to-day the river was one vast field of ice, cakes varying in size from three to one hundred feet square; trees, logs, bridge timbers, the debris of houses, &c., were constantly passing. Sioux City, Ia., 8th, ice gorge below city still intact. 9th, heavy floating ice in river. Mandan, Dak., 8th, the immense fields of ice about the city still intact; over one hundred men employed in cutting out the railroad track and in opening a road through the heavy ice on Main street. Ft. Sully, Dak., 25th, river clear of ice; first boat arrived. Gayville, Dak., 15th, town submerged to a depth of six feet, and surrounded by heavy ice. *Mississippi River.*—St. Paul, 6th, ice broke up; 7th, gorged; 9th, gorge broke; 10th, river full of floating ice. Davenport, 1st, ice broke up in the channel over the rapids; 2nd, river open from the bridge down to the ferry crossing at the foot of Main street; at some places along the shore ice piled up to a height of 30 feet, composed of huge blocks three feet in thickness; at the Government bridge ice was gorged over five acres in extent; 3rd to 13th, floating ice, occasionally heavy; 15th, completely filled the river at many places, and extended for ten miles; ice varied in thickness from fourteen to twenty-four inches; navigation open; 16th, areas of thirty to forty acres passed down in a body; levee flooded for two miles; at 11 a. m., water stood seven inches deep in stores, warehouses and machine shops on Front street, and whole blocks of dwelling houses were inundated; saw mills suffered heavily, many piles of lumber and rafts swept from their booms; one raft of 600,000 feet of lumber was broken up and carried away in front of the city. At 11.45 a. m., water rose to 18 feet 8 inches above low-water mark, being 4 inches higher than ever before recorded. Burlington, Ia., 1st to 3rd, heavy floating ice, occasionally gorging; 4th, navigation open, floating ice, but not seriously impeding the movement of vessels; 5th to 16th, floating ice, occasionally heavy; 17th, river clear of ice. Clinton, Ia., 14th, ice broke up and passed out, causing but little damage; 16th, navigation open, being one week later than any previous spring for the past 20 years; river closed for 149 consecutive days. Dubuque, Ia., 5th, ice moving slowly; 8th, ice gorged; 9th, gorge broken by use of dynamite; 12th, navigation open. Little Falls, Minn., 19th, ice passed out, causing no serious damage; streams very low for this season of the year. *Saskatchewan River.*—Battleford, B. A., 20th, ice broke up; 21st, ice gorged and river overflowed; 22nd, river higher than ever before, all bridges for miles about swept

away; every house in lower part of town flooded; water of unusual depth in swamps along the line of the Canada Pacific, between Winnipeg and Portage la Prairie, owing to the sudden melting of heavy snow. *Red River of the North*.—Winnipeg, B. A., 22d, ice began moving at 11 a. m., first movement since the setting in of winter. Two barges were carried away near the mouth of the Assiniboine river by the descending ice. Pembina, Dak., 22nd, ice in river began moving at 11:30 a. m., water rising at the rate of two inches per hour. Breckinridge, 27th, river clear of ice from this point to Lake Winnipeg; river 25 to 30 feet above low water mark and rising. Grand Forks, Dak., 21st, ice in river breaking away from shore and gorged at several places; 29th, river entirely free of ice; all buildings on the bottom lands washed away; ice gorged at the mouths of several small tributaries, flooding the low lands for 25 miles between Turtle river and Acton. Fargo, Dak., 22nd, ice began to break up and move out slowly; no serious damage. *Big Stone River*.—Elk Point, Ia., 15th, railroad track covered with ice for miles; ice carried inland by the flood, in some places to a depth of four feet. *Minnesota River*.—Granite Falls, Minn., 22nd, river clear of ice at this point, but gorged heavily at a bend of the river below the town. Minnesota Falls, 22nd, gorge broke and carried away wagon bridge; loss \$4,000. *James River*.—Morrison, 19th, ice broke up; 20th, water flooded valley; 23rd, river reached its greatest height; average depth on low lands 9 feet. *Pepin Lake*.—Lake City, Minn., 24th, ice breaking up and occasionally gorging; 25th, ice passed out; Mississippi now open above and below. *Red Wing, Minn.*, 23rd, ice in lake still firm; river has risen three feet and still rising. *Nebraska River*.—Nebraska, Neb., 8th, ice heavily gorged on either side for miles; river rising rapidly. *Sheboygan River*.—Mission House, Wis., 22nd to 25th, ice breaking up and passing out, causing much loss of property, especially bridges, mills and dams. Manitowoc, Wis., 20th, river open, water higher than ever before; ice passed over the banks, carrying away fences, bridges and dams. *Milwaukee River*.—Milwaukee, Wis., 20th, ice breaking up; 21st, gorging heavily in places, river overflowed; 22nd, ice gorge passed out, carrying away a portion of wagon bridge, and causing considerable other damage. *West Branch Canal*.—Milton, Pa., 15th, ice breaking up; 16th, passing out slowly with occasional gorges; 17th, navigation open. *Lake Geneva*.—Bloomfield, Wis., 30th, ice 18 inches thick and still firm. *Rock River*.—Beloit, Wis., 27th, river 54 feet above low water mark, highest water ever known, much damage to property. *Black River*.—Neillsville, Wis., 26th, ice all out, no serious damage. *Fox River*.—Elgin, Ill., 21st, ice gorged for a distance of nine miles, and piled up to a height of 12 feet, damage to property already \$500,000. *Rock River*.—Lyndon, Ill., 16th, ice broke up in river; 20th, water highest ever known. Rockford, Ill., 21st, river rose from 4 inches above low water mark on the 12th to 58½ inches on the 20th, highest water ever known. *Lake Michigan*.—Chicago, 1st to 11th, lake frozen firmly along shore; 12th, ice began moving. Milwaukee, 1st to 25th, bay covered with ice; 26th, ice broke up and passed out; 30th, clear of ice. Benton Harbor, Mich., 2nd, ice broke up, destroying over 500 feet of Pike's pier; at Riverside 2,500 railroad ties carried away. *Green Bay*.—Escanaba, frozen over during month. *Lake Superior*.—Duluth, 1st to 26th, lake frozen solid as far as the eye can reach; 27th, ice broke up during the morning; 28th, moved out in lake 10 miles; 30th, entirely disappeared. Marquette, harbor covered with ice during the month. *Grand River*.—Grand Haven, 1st to 7th, frozen over; 8th, ice broke up; 10th, river clear. *Alpena River*.—Alpena, 1st to 17th, river frozen over; 18th, ice broke up and passed out, causing no damage; 19th to 21st, full of floating ice; 22nd, clear of ice. *Detroit River*.—Detroit, 2nd to 5th, heavy floating ice; 6th, 7th, light floating ice; 8th to 12th, heavy; 13th, light; 14th, heavy; 15th, heavy, reaching from shore to shore; 16th to 18th, light; 19th, clear of ice. *Lake Erie*.—Cleveland, 24th, lake covered with broken ice, but not impeding navigation. Little Mountain, Ohio, 30th, ice along the shore still intact. Erie, Pa., 5th, ice in bay rapidly disappearing, with a clear opening extending from channel to waterworks, and from shore to shore; outside of bay fields of ice stretch as far as the eye can reach; outlook very unfavorable to the early opening of navigation. Cleveland, 1st to 18th, lake closed by ice; 19th, ice moved out from around docks; 20th to 24th, ice remained stationary; 25th, ice disappearing. *Sandusky Bay*.—Sandusky, 1st to 10th, bay frozen over; 11th, ice breaking up; 15th, clear of ice. *Lake Ontario*.—Oswego, 18th, ice melting and disappearing; 25th, lake clear of ice. Rochester, 11th, ice disappeared from harbor; 15th, floating ice in lake; 22nd, lake clear as far as eye can reach. *Lake Champlain*.—Plattsburg Barracks, N. Y., 16th, ice broke up. Burlington, Vt., 1st to 19th, broad lake frozen over; 20th, ice breaking up; 21st, ice passed out. *Lake Massabesic*.—Auburn, N. H., 20th, lake free of ice.

*Floods*.—This subject assumes more than usual interest during the present month, because of the unprecedented loss of life and property, and, not least, the extreme height to which the water rose during the prevalence of the flood. In connection herewith, as presenting some of the probable causes which were at work in the production of this great calamity other than the immediate influence of the breaking up of ice, it will be well to note that in the Northwest, up to about the 12th, snow was upon the ground to the depth of 15 to 50 feet, the accumulation of almost the entire winter, and in the Upper Mississippi valley as far south as Burlington, Iowa, it varied from 3 to 5 feet. In this connection it will be of interest to recall the fact that, during the month of March just past, these regions were subjected to the heaviest snow-storms experienced, in many

instances, for a period of twenty-five years. With this remarkable accumulation of snow there appeared the preserving concomitant of very low temperatures, for, as records will show, the mean temperature for March throughout the Upper Mississippi and Missouri valleys was from  $-1.4^{\circ}$  to  $-3.1^{\circ}$  below the normal, a very important factor, and tending materially to prevent the gradual and, therefore, harmless disappearance of the large mass of snow. Further, it will be remembered that, during the past winter, ice formed in the western rivers to a thickness and extent, in several instances, never before realized. With these conditions precedent, the month of April opened with occasionally heavy falls of snow and low temperatures, the minimum of the month, which ranged from  $-14^{\circ}$  to  $+18^{\circ}$ , occurring between the 1st and 12th. Following this, the temperature rose slowly until the 20th, after which the change was more rapid, reaching the maximum of the month between the 22nd and 26th. It would seem that in the above we have an epitome of the principal forces incident to the remarkable floods of April, 1881. Roughly estimated, but, nevertheless, said to be underrated, rather than exaggerated, the loss of property has been placed in money value at the following figures: Over the territory from British America southward to the latitude of Sioux City, Iowa, \$3,500,000; from Sioux City to the latitude of St. Louis, \$2,500,000. *British America*.—Manitoba, 22nd, all streams emptying into the Red River of the North overflowed, great loss to lumbermen and farmers. Winnipeg, 29th, river 25 feet above low water mark, several grain warehouses flooded. Emerson, 29th, lower portion of town flooded, bridge carried away. *Dakota*.—Vermilion, 8th, forty-five houses swept out of the town, highest water ever known. Grand Forks, 21st, Red river rose 16 feet in past thirty-six hours. Casselton, 22nd, entire town nearly under water, flood unprecedented, all communication closed. Meckling, 8th, entire town carried away, except the elevator, in which were gathered for safety about 1,000 people. Fort Sisseton, 22nd, all bridges between this point and Brown Valley carried away; the entire valley on the Dakota side of the Minnesota river covered to a depth of several feet. Mapleton, 22nd, town completely submerged, loss of property very great. Yankton, 8th, bottom lands for miles in every direction submerged, nearly 1,000 people have been rescued from farm houses and other buildings in this county alone; some people in their dwellings are still surrounded by ice walls of almost impenetrable character; 14th, in the district between Yankton and Vermillion, a distance of 25 miles, 2,500 people were suffering for the necessities of life, and below Vermillion to Big Sioux 5,000 more were completely destitute; from the records of the Surveyor General's office, it has been ascertained that the flood on the Dakota side of the Missouri, covered over 227,000 acres. Pierre, 8th, town completely under water; the floods in this section and for miles on either side are unparalleled; the bottom lands for a width of over fifteen miles were overflowed, making a perfect inland sea. Big Stone City, 23rd, Wheatstone River overflowed, flooding the country for miles; Big Stone Lake 7 feet above high-water mark, highest ever known; all bridges gone and several miles of the Hastings and Dakota Railroad washed away. Union County, 15th, water disappearing rapidly, leaving thousands of acres covered with huge cakes of Missouri ice, hay and straw stacks, wire fences, wrecked houses, and the debris of bridges. Civil Bend, 15th, heavy river ice covered the fields for miles to the depth of 6 to 8 feet, rendering travel of any kind almost impossible; all sloughs filled with water and have to be crossed in skiffs; houses either wrecked by the ice or floated off by the water; hay, grain, fences, saw-logs, lumber and cord wood, entirely swept away; loss of stock very severe. Fargo, 23rd, Red River rose four feet during night, but could rise ten feet more without serious damage; at Williams' farm, 16 miles west, entire country flooded. *Illinois*.—Rockford, 20th, majority of town flooded, water in many cases flowing into the windows of dwellings; water 22 inches higher than the high-water mark of 1877; river two to three miles wide; loss of property in Kane County estimated at \$300,000; in the newspaper offices, men at work with a foot of water beneath them. Sterling, 20th, Rock River 12 feet above low-water mark and rapidly rising; lower part of city flooded; Chicago and Northwestern Railroad covered with water for five miles; river between Sterling and Erie overflowed, submerging the country for many miles; loss of property estimated at \$150,000. Milan, 20th, town partially submerged, bridge swept away; loss, \$20,000. Chicago, 19th, Desplaines River greatly swollen and pouring into the canal; 20th, canal broke its barriers, flooding all cellars and basements in vicinity; flood spread considerably in southwestern part of city; several lumber yards inundated and all the docks on the south side were invisible; at 2 p. m., flood extended from Lincoln street to the river, a distance of over two miles; canal filled with floating corn and hay, brought down the river from inundated farms in the surrounding country; water several inches higher than the flood of 1847, which was the highest point ever reached; 21st, flood increasing; only four cars of freight arrived during day; every railroad track that enters the city covered with water; several street bridges washed away. Elgin, 20th, Fox River overflowed, portion of city submerged, two bridges and a dam swept away; loss, \$150,000; bridges and dams at Carpenterville, Dundee, South Elgin, St. Charles and Geneva were carried away; loss, \$200,000; flood so irresistible that buildings were swept down the stream like shingles; Milwaukee and St. Paul Railroad bridge carried away, severing all communication westward for twelve days. Rock Island, 15th, 11 a. m., three fourths of the city under water, general depth in business part of town 12 inches, while in the lower portions it was from three to four feet; 200 families driven from their homes; 11.45 a. m., gorge broke, water receding four feet in thirty minutes. Joliet, 20th, Desplaines River highest ever known; lower portion of city flooded; damage to property \$50,000.

Dixon, 19th, Rock River overflowed, much damage to property. Quincy, 20th, all low lands above and below the city entirely inundated; river five miles wide; thousands of acres of farming lands overflowed; much loss of stock, farm machinery and buildings. Venice, 25th, town entirely surrounded by water; people abandoning their houses. Madison, 25th, new levee broken; all farms on the American bottoms flooded; loss of stock, farm buildings and implements very great.

*Iowa.*—Ft. Dodge, 25th, Des Moines River overflowed; rose 6 feet in 30 hours; families on low lands abandoned their homes. Iowa Point, 30th, water up to the windows of the depot; every house flooded. Plum Hollow, 29th, great destruction of property and much suffering on the bottom lands throughout Fremont County; hundreds of families driven from their homes; flood unprecedented. Hamburg, 29th, railroad track from this point to Council Bluffs entirely washed away; all telegraph poles down; town flooded, houses abandoned. Sioux City, 8th, portion of city flooded to a depth of 4 to 6 feet; 21st, Big Sioux, Floyd, and other streams overflowed, causing great damage to wagon and railroad bridges; 29th, water rose 2 feet in past 24 hours; many families driven from their homes in the surrounding country by the overflow of creeks and small rivers. Lemars, 22nd, Floyd River overflowed; several bridges swept away together with 200 feet of railroad track. Des Moines, 22nd, river falling; debris of buildings and bridges floating by for several days. Council Bluffs, 8th, all bottom lands about the city completely under water and many families in the suburbs compelled to abandon their homes; 9th, water rising rapidly; nearly one-half of the city submerged to a depth of three feet; people rapidly deserting their homes; a broad and heavy stream coming in from a bend in the river north of the town swept down Broadway, the principal business street, carrying away a large amount of property; on the west side of the town the Union Pacific transfer depot, the bridges over Spoon Lake, together with the Union Stock Yards and numerous residences and railroad buildings, were inundated; all railroad communication has ceased; all transfers have to be made by boats, or by shoving flat cars through the water over the small bridges; several hundred loaded freight cars were entirely submerged; the Kansas City, St. Joe and Council Bluffs R. R., from the latter place to Pacific Junction, a distance of eighteen miles, was completely under water; ice piling up fast all over the flooded section; 22nd, river rising at rate of one inch per hour; all bottom lands flooded to a depth of four to six feet; railroad tracks and the Union depot inundated; water 17 inches higher than ever before known; 23rd, river now eight miles wide; over 500 houses in southern part of city surrounded by water; all communication with Omaha cut off; 29th, water 22 feet above low-water mark; 300,000 feet of lumber washed away during day by breaking away of coffer-dam.

*Kansas.*—Burr Oak, 30th, town entirely flooded, water reaching to the eaves of many buildings; inhabitants floating about on rafts or buoys day and night. Elmwood, 30th, town submerged; inhabitants lost everything. Wathena, 30th, town flooded; people passing about in skiffs or on rafts; houses abandoned. Belmont, 30th, all bottom lands under water; town abandoned. George City, 30th, lower portion of city and the adjacent bottoms submerged; all railroad communication cut off; highest water ever known. Atchison, 25th, water 20 feet 8 inches above low-water mark; highest point ever reached; all houses on the east bank south of railroad track flooded; brick stack over 200 feet from shore; all low lands between the timber belt and town submerged; ice houses at Sugar Lake undermined and destroyed; 26th, East Atchinson entirely surrounded with water; people leaving in boats for places of safety. Oak Mills, 29th, entire town swept away; large island near by, upon which were gathered all the stock of the neighborhood, was submerged, drowning the animals. Troy, 30th, all bottom lands overflowed; water highest ever known; town deserted. Leavenworth, 12th, river overflowed; all railroad travel suspended; 14th, river falling; 15th, railroad travel resumed; 22nd, water rising; railroad track again submerged; 23rd to 26th, river rising slowly; bottom lands overflowed and much property washed away; 27th, water 5 to 20 feet deep over the bottoms, with a width of over two miles; all buildings abandoned; several miles of railroad track washed away; river filled with debris of every description, showing that destruction of property above has been immense; 28th, river rose rapidly all day, houses and barns carried away and much stock along the Missouri river bottoms drowned; opposite city, bottoms from 3 to 10 feet under water; over 100 families left destitute; town of east Leavenworth entirely abandoned and several houses floated away; river over three miles wide; highest water since 1844.

*Michigan.*—Alpena, 29th, Richardson's dam near mouth of Alpena river carried away by unprecedented high water; 500,000 feet of logs swept out into the bay.

*Minnesota.*—St. Paul, 29th, water 19½ feet above low water mark; west St. Paul entirely submerged; every house abandoned; water so deep that some of the houses only showed their gables above the flood; river full of debris of every description, coming down from the upper portions of the State; hundreds of cattle, horses and hogs drowned in the surrounding country; on the east side, flats above the city covered with water and the Sioux City shops and stock yards surrounded. The following are dates of highest water for many years past: June, 1851; July and August, 1852; April, 1862; April 23rd, 1866; April 19th and July 20th, 1867; April 18th, 1869; April 1st, 1870. Loss to railroads and private property, over \$100,000. Cassilton, 25th, Red Lake River overflowed, inundating the town; people abandoning their homes. Bell Plain, 25th, bottom lands covered to a depth of five feet. Lenseur, 25th, town partially under water; wagon bridge carried away. Halleck, 25th, all low lands under water; highest water ever known. Redwood Falls, 22nd, Minnesota river highest since 1868; water fifteen feet above low-water mark; Ramsey creek 11 feet above low-water mark, highest since the floods of 1870; all dams and bridges

in vicinity carried away. Le Sueur, 22nd, river covered the entire valley between the bluffs, water rising two inches per hour; 23rd, water rose 30 inches during night; Henderson bridge carried away; greatest flood ever experienced in this section. Mankato, 23rd, lower portion of town flooded to a depth of several feet; West Mankato, Le Hillier and the city flats covered with water 2 to 5 feet deep; several hundred cords of wood carried away; Mineopa and Warren creeks overflowed, causing much damage in the vicinity; warehouses at Gardiner City, containing 7,000 bushels of wheat, swept away; all railroad tracks completely washed out. Marshall, 22nd, Redwood river overflowed; bottom lands under water, and also all of the railroad tracks between this place and Amaret. Springfield, 22nd, Cottonwood river overflowed; thousands of acres under water; all communication cut off. Carver, 22nd, river 10 feet above low-water mark; portion of the town under water. Huron, 22nd, James river overflowed; several buildings submerged to a depth of three feet. Sleepy Eye, 22nd, surrounding country submerged; all railroad travel closed. Burns, 22nd, Cottonwood river overflowed; railroad bridge and 80 feet of track carried away. St. Peter, 22nd, river rising very rapidly, washing away over 700 feet of railroad track; river opposite town over a mile wide; largest portion of town flooded. Granite Falls, 25th, town entirely surrounded by water; all bridges carried away. Minnesota Falls, 23rd, all the bottoms covered to depth of 4 to 6 feet; water highest ever known. St. James, 22nd, Watonwan river overflowed; railroad bridges at Wadellia carried away; all railroad communication cut off. Shakopee, 23rd, water  $3\frac{1}{2}$  feet above low-water mark, or 26 inches higher than ever before recorded, damage to property very great. Brainerd, 23rd, water at ordinary stage in upper Mississippi; no prospects of flood yet. Big Stone, 28th, town flooded; railroad tracks washed away; highest water ever known. Sioux Falls, 22nd, three street bridges carried away; property of the Sioux Falls Water Power Co., seriously damaged; 27th, several flouring mills carried away; every building in the town more or less damaged; loss estimated at \$140,000. Fergus Falls, 25th, upper country one unbroken sheet of water for about 25 square miles. Ortonville, 25th, bottom lands covered with 4 feet of water; highest flood ever experienced. Crookston, 25th, all the low lands between this place and Glyndon overspread with ice, carried up by overflowing rivers and creeks; Red Lake river above its banks; wagon bridge carried away. Stevenson, 25th, surrounding country covered with water; railroad tracks washed out; all communication closed. Montevideo, 22nd, river higher than for many years; water extends from bluff to bluff in a vast lake, varying in depth from 8 to 10 feet; in lower portion of town houses filled with 4 to 8 feet of water; bridge across the Chippewa river carried away; all communication cut off; 23rd, water still rising rapidly; all of the bottom lands at the confluence of the Minnesota and Chippewa rivers one vast sea of water, covering many thousands of acres; many miles of railroad track washed away; all bridges on Dry Weather creek carried away. St. Cloud, 23rd, Mississippi at ordinary stage, not as high as one year ago, but rising slowly; Sank river, two miles above town, rising very rapidly. Log driving on Daggett brook, the Willow, Partridge and other small rivers, tributary to the Mississippi, has commenced without fear of floods. *Missouri.*—Craig, 25th, water three feet deep in stores and houses; all business suspended; portion of town abandoned. Phelps City, 25th, town nearly submerged; inhabitants fled to the bluffs for safety; highest water and most destructive flood ever known. St. Joseph, Mo., 25th, river 27 feet 9 inches above low-water mark, or 9 inches above the highest point ever reached; French bottoms, above city, flooded; people abandoned their houses; opposite city all lands flooded; inhabitants fled to the hills for safety; railroad machine shops surrounded and all tracks under water. Hannibal, 21st, railway tracks on Front street submerged; steamboat warehouses entirely surrounded; 25th, 3 a. m., Sny levee broke at a point  $1\frac{1}{4}$  miles above East Hannibal, crevasse 130 feet and still cutting; loss of ice, up to date, about 28,000 tons; river over 10 feet above low-water mark and still rising. Forrest City, 25th, levee built to protect town of Harlem and the broad bottom lands opposite city gave away during the night, flooding the latter to a depth of 10 feet; in the town of Harlem only six houses above the water-line, a large number of neighboring farms 4 to 6 feet under water; 29th, 7,000 people driven from their houses; all the railroad tracks under water; business entirely suspended; over 1,500 houses flooded and abandoned. St. Louis, 25th, Sny levee broke during the evening opening a crevasse 175 feet wide, flooding 40,000 acres of growing wheat; estimated value of ice houses and ice destroyed; over \$100,000; about 40 miles of the Keokuk and St. Louis R. R. inundated. 25th, large portion of North St. Louis and Carondelet submerged, all bottoms on the Missouri side flooded, and situation on the Illinois side very deplorable; all buildings and railroad tracks between the stock yards and Venice badly damaged, water several feet deep. Lexington, 29th, river 22 feet and 8 inches above low-water mark, highest since 1844; the Roy and Lafayette county bottoms submerged and rapidly depopulated; thousands of horses, cattle and hogs perished, water seven feet deep in many of the houses. Oregon, 24th, all the bottom lands flooded, about 3,000 people in Holt county rendered homeless; river reached its highest point on the 27th, higher than ever before experienced, not excepting the great flood of 1844. *Nebraska.*—Covington, 8th, town completely submerged and entirely abandoned by its inhabitants. Brownville, 25th, town partly under water, all business suspended. White Cloud, 26th, river highest ever known, railroad tracks washed out, several buildings under water. Doniphan, 26th, water highest since the flood of 1844, all the low lands under water, great loss to railroad and other property. Nebraska City, 26th, river at this point 10 miles wide; it is estimated that about 10,000 head of cattle have perished along the bottom

lands. Jackson, 7th, entire portion of state between this point and Covington submerged, all communication cut off, loss of property without precedent; no such flood since the settlement of the country. Plattsburgh, 23rd, all bottom lands under water to a depth of six to eight feet, farmers on Iowa side have abandoned their houses and report heavy losses of cattle. Pacific Junction, 23rd, town submerged to a depth of four to eight feet; great suffering and much loss of property. Omaha, 8th, river 21 feet above low-water mark, highest ever known here and  $2\frac{1}{2}$  feet higher than the April flood of 1875 or the June flood of 1867; everything on the levee submerged and the low lands on the east side of the river flooded for miles; river three miles wide opposite the city and filled to a considerable extent with floating ice; twelve of the largest buildings of the U. P. R. R. Co.'s shops were flooded to a depth of six to twelve inches and 1,300 men temporarily thrown out of employment. 9th, river opposite city increased to a width of six miles; damage to property immense. 20th, water 20 feet above low-water mark; all the bottoms again submerged; railroad business entirely suspended, shops and depots flooded. 22nd, water 22 feet 10 inches above low water mark and rising at the rate of one inch per hour; all railroad connections severed; Union stock yards flooded; 300,000 feet of lumber carried away; Elkhorn river overflowed, railroad partially carried away. 23rd, 2 p. m., river 23 feet and 4 inches above low-water mark, or 16 inches higher than ever before recorded; all passengers going east compelled to pass to the local depots in boats; \$30,000 worth of lumber carried away. 24th, water 4 feet higher than the flood of 1867; current very rapid; all railroad tracks washed away. 29th, water still rising; 50,000 feet of lumber carried away; the Union Pacific R. R. shops, smelting works, Willow Springs distillery and several large warehouses flooded. *Texas*.—Huntsville, 22nd, heaviest storm of rain ever known here; surrounding country flooded; all bridges carried away; crops seriously damaged. *Wisconsin*.—Beloit, 20th, town partially inundated; great loss to mill property. Fort Atkinson, 20th, all the low lands flooded; ice came down in huge masses, crushing bridges, dams and every obstacle in its path; water rose to within a few inches of the top piers of the city bridge; highest ever known. Milwaukee, 21st, flood, highest and most destructive ever known here; basements along the docks and several lumber yards and tanneries submerged. At West Bend, Thevisville, Newburg and other neighboring places all dams and bridges gone.

## TEMPERATURE OF WATER.

*The temperature of water*, as observed in rivers and harbors at Signal Service stations, with the average depth at which observations were taken, is given in the table on the left hand side of chart No. III. Owing to ice, breakage of instruments and opening of new stations, observations are wanting as follows: Atlantic City, 1st to 20th; Alpena, 1st to 17th; Boston, 1st to 21st; Burlington, Vt., 1st to 20th; Cleveland, 1st to 18th; Chicago, 1st to 11th; Detroit, 1st to 5th, 15th and 16th; Duluth, 1st to 26th; Escanaba, 1st to 31st; Grand Haven, 1st to 7th; Marquette, 1st to 31st; Milwaukee, 1st to 25th; Newport, 1st to 24th; New Haven, 1st to 22nd; New Shoreham, 1st to 16th; Port Eads, 1st to 9th; Sandusky, 1st to 10th.

## ATMOSPHERIC ELECTRICITY.

*Auroras*.—There have been an unusual number of displays reported from the Lake region. Most of them occurred on dates coincident with those in other districts to the east and west, thus completing the connection which frequently has been wanting over this region, from one cause or another, generally presumed to be cloudiness and therefore frustrating any attempt to trace a continuous line of observation from east to west, which, from the nature of auroral display is known to be its ordinary disposition. The most important display, where the continuity of observation was unbroken, occurred on the 27th and extended from Mt. Washington to stations in Oregon and Washington Territory and as far south as latitude  $38^{\circ}$ , seventeen intervening stations reporting. The following were less extended displays but generally visible from New England westward to the Mississippi. 17th, from northern Vermont to northern Indiana and south to latitude  $41^{\circ}$ , two intervening stations reporting. 18th, from Mt. Washington to Madison, Wis., and south to latitude  $43^{\circ}$ , seven intervening stations reporting. 19th, from Halifax, N. S., to Escanaba and as far south as latitude  $42^{\circ}$ , six intervening stations reporting. 20th, from Sydney, Cape Breton Island, to Fort Stevenson, Dak., and southward to latitude  $38^{\circ}$ , twenty-seven intervening stations reporting. 21st, from Buffalo to Fort Stevenson, Dak., and southward to latitude  $43^{\circ}$ , two intervening stations reporting. 24th, from Eastport, Me., to Spiritwood, Dak., and southward to latitude  $45^{\circ}$ , three intervening stations reporting. 28th, from Halifax, N. S., to Spiritwood, Dak., and southward to latitude  $40^{\circ}$ , fifteen intervening stations reporting. 30th, from Catawissa, Pa., to Vevay, Ind., and southward to latitude  $39^{\circ}$ , one intervening station reporting. The following were local displays: Williamstown, Mass., 3rd, 8:30 p. m., faint; Burlington, Vt., 4th, 9 to 11 p. m.; Albany, 1st, 11 p. m. to midnight; Duluth, 1st, until 3 a. m.; St. Vincent, Minn., 3rd; Ft. Brady, Mich., 1st, 9 p. m., faint; Eola, Or., 15th, p. m., very faint.

## MISCELLANEOUS PHENOMENA.

*Sunsets*.—The characteristics of the sky at sunset, as indicative of fair or foul weather for the succeeding twenty-four hours, have been observed at all Signal Service stations. Reports from 177 stations